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EXAMINER	
FETZNER, TIFFANY A	
ART UNIT	**PAPER NUMBER**
2862	

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Please find below and/or attached an Office communication concerning this application or proceeding.

PTO-90C (Rev. 07-01)

Office Action Summary	Application No. 09/682,699	Applicant(s) Brittain
	Examiner Tiffany Fetzner	Art Unit 2862

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1) [X] Responsive to communication(s) filed on *Oct 5, 2001*.

2a) [ ] This action is **FINAL**. 2b) [X] This action is non-final.

3) [ ] Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

4) [X] Claim(s) *1-30* is/are pending in the application.

4a) Of the above, claim(s) ______ is/are withdrawn from consideration.

5) [ ] Claim(s) ______ is/are allowed.

6) [X] Claim(s) *1-30* is/are rejected.

7) [ ] Claim(s) ______ is/are objected to.

8) [ ] Claims ______ are subject to restriction and/or election requirement.

Application Papers

9) [ ] The specification is objected to by the Examiner.

10) [X] The drawing(s) filed on *Oct 5, 2001* is/are a) [ ] accepted or b) [X] objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11) [ ] The proposed drawing correction filed on ______ is: a) [ ] approved b) [ ] disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12) [ ] The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13) [ ] Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a) [ ] All b) [ ] Some* c) [ ] None of:

1. [ ] Certified copies of the priority documents have been received.
2. [ ] Certified copies of the priority documents have been received in Application No. ______.
3. [ ] Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

*See the attached detailed Office action for a list of the certified copies not received.

14) [ ] Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

a) [ ] The translation of the foreign language provisional application has been received.

15) [X] Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) [X] Notice of References Cited (PTO-892)	4) [ ] Interview Summary (PTO-413) Paper No(s). ______
2) [ ] Notice of Draftsperson's Patent Drawing Review (PTO-948)	5) [ ] Notice of Informal Patent Application (PTO-152)
3) [X] Information Disclosure Statement(s) (PTO-1449) Paper No(s). 2	6) [ ] Other:

DETAILED ACTION

1. *Claim Rejections - 35 USC § 112*

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. **Claim 26** (i.e. "Fourier transforming MR data in z") recites the limitation "MR data" in line 2 and depends from **claim 22**, but **claim 26** lacks teaching that the computer method is implemented on an "MR system" therefore there is insufficient antecedent basis for this limitation in the claim.

4. *Drawings*

5. **Figures 1-7** should be designated by a legend such as --Prior Art-- because only that which is old is illustrated. See MPEP § 608.02(g). A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

6. Applicant is required to submit a proposed drawing correction in response to this Office Action. Any proposal by the applicant for amendment of the drawings to cure defects **must consist of two parts:**

A. A separate letter to the Draftsman in accordance with M.P.E.P. (608.02(r); and

B. A print or pen-and-ink sketch showing changes in red ink in accordance with M.P.E.P. (608.02(v)).

IMPORTANT NOTE: The filing of new formal drawings to correct the noted defect may be deferred until the application is allowed by the examiner, but the print or

pen-and-ink sketch with proposed corrections shown in red ink is required in response to this Office Action, and *may not be deferred.*

7. ***Claim Rejections - 35 USC § 102***

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless -
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

9. **Claims 1-29** are rejected under **35 U.S.C. 102(e)** as being anticipated by **Machida** US Patent Application Publication US 2002/0115929 A1 published August 22nd 2002 which has an effective filing date available under **35 U.S.C. 102(e)** of September 21st 2001. The examiner notes that the instant application is a CIP of US patent application 09/681,420 filed march 30th 2001, however the CIP information of applicant's disclosure has a filing date of October 5th 2001, therefore the **Machida** reference is available as prior art against the CIP feature of "continuous motion" taught in applicant's claims.

10. With respect to **Claim 1**, **Machida** teaches and suggests "A method of imaging large volumes without resulting slab-boundary artifacts comprising: defining a desired FOV larger than

an optimal imaging volume of an MR scanner;" [See **Machida** page 1 paragraphs 0014, 0015, 0005; page 2 paragraphs 0020, 0021, and page 7 paragraph 0114] **Machida** also teaches, shows, and suggests "selecting a slab thickness in a first direction that is smaller than the desired FOV and within the optimal imaging volume of the MR scanner;"[See **Machida** page 1 paragraphs 0015, 0016, page 2 paragraph 0020; page 5 paragraphs 0064; and Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] "and continuously moving one of the optimal imaging volume and an imaging object in the first direction while repeatedly exciting and encoding spins with readout in the first direction to acquire data that is restricted to the selected slab thickness until at least one image of the FOV can be reconstructed". [See **Machida** abstract, page 1 paragraph 0015 through page 7 paragraph 0114; and Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b]

11. With respect to **Claim 2, Machida** teaches, shows and suggests "the step of using another set of MR data to track motion of one of the optimal imaging volume and an imaging object". [See **Machida** page 2 paragraph 0018 page 4 paragraph 0053 through page 6 paragraph 0088 and Figures 2, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 2**.

12. With respect to **Claim 3, Machida** teaches, and suggests "reconstructing the acquired data to form at least one of a 2D image and a 3D image." [See **Machida** page 3 paragraph 0048, where the use of two-dimensional or three-dimensional Fourier image reconstruction directly suggests the reconstruction of "at least one of a 2D image and a 3D image" page 6 paragraph 0099 and Figure 1] The same reasons for rejection, that apply to **claim 1** also apply to **claim 3**

13. With respect to **Claim 4**, **Machida** teaches, shows, and suggests "the step of using a portion of the acquired MR data to track motion of one of the optimal imaging volume and an imaging object." [See **Machida** page 4 paragraph 0053 through page 7 paragraph 0114 and Figures 2, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 4**.

14. With respect to **Claim 5**, **Machida** teaches, shows, and suggests "restricting data acquisition by encoding and filtering data so as to acquire data that is limited to the selected slab thickness." [See **Machida** page 4 paragraph 0056 through page 5 paragraph 0066; page 1 paragraph 0016; page 2 paragraphs 0023 through 0025; page 7 paragraphs 0103 through 0115; abstract and Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 5**.

15. With respect to **Claim 6**, **Machida** teaches, shows, and suggests "restricting excitation in at least one direction other than the first direction." [See **Machida** page 2 paragraph 0019; page 6 paragraphs 0090 through page 7 paragraph 0115; page 1 paragraph 0015, and Figures 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 6**.

16. With respect to **Claim 7**, **Machida** teaches, shows, and suggests "the first direction is defined as a z-direction." [See **Machida** page 4 paragraph 0053; Figures 2,4a, 4b, 4c, 4d, 5a,] The same reasons for rejection, that apply to **claim 1** also apply to **claim 7**.

17. With respect to **Claim 8**, **Machida** teaches, shows, and suggests "each MR data acquisition during continuous movement includes acquiring all k-space data in a direction of motion of a patient table for a selected subset of transverse k-space data." [See **Machida** page 4

paragraph 0053 through page 6 paragraph 0099; Figures 2,3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 8**.

18. With respect to **Claim 9**, **Machida** teaches, shows, and suggests "reducing, exam time by imaging during table motion." [See **Machida** page 2 paragraph 0025; page 6 paragraph 0088; page 7 paragraphs 0110 through paragraph 0114; Figures 2,3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 9**.

19. With respect to **Claim 10**, **Machida** teaches, shows, and suggests "processing the set of MR data using a gridding reconstruction". [See **Machida** page 5 paragraphs 0064, 0065; 0084 through page 6 paragraph 0088; Figures 2, 4a, 4b, 4c, 4d, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 10**.

20. With respect to **Claim 11**, **Machida** teaches, shows, and suggests "the step of maintaining a position of slab thickness fixed relative to a magnet of the MR scanner during imaging of the desired FOV and the continuous moving of one of the optimal imaging volume and the imaging object. [See **Machida** page 1 paragraphs 0016, 0017; page 4 paragraph 0053 through page 5 paragraph 0066; Figures 2, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 11**.

21. With respect to **Claim 12**, **Machida** teaches, shows, and suggests "applying gradient waveforms on an axis parallel to the first direction while acquiring imaging data." [See **Machida** page 3 paragraphs 0042, 0043; page 4 paragraph 0053 through page 6 paragraph 0091; Figures 2, 3] The same reasons for rejection, that apply to **claim 1** also apply to **claim 12**.

22. With respect to **Claim 13**, **Machida** teaches, shows, and suggests "processing MR data to account for accrued phase resulting from table velocity; [See **Machida** page 6 paragraph 0090 through page 7 paragraph 0114; Figures 5a, 5b, 6, 7a and 7b] "transforming MR data in a z-direction;" [See **Machida** page 3 paragraphs 0040 and 0048] "correcting the MR data for spatial variations in the magnetic field in the direction of motion" [See **Machida** page 7 paragraph 0106 through paragraph 0114; Figures 5b, 6] "removing unnecessary data at the beginning and ending of each acquisition;" [See **Machida** page 4 paragraph 0053 through page 6 paragraph 0089; Figures 1, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] and "sorting, interpolating, and aligning the transformed MR data to match anatomic locations in the first direction." [See **Machida** page 4 paragraph 0053 through page 6 paragraph 0088; Figures 1, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claim 1** also apply to **claim 13**.

23. With respect to **Claim 14, Machida** teaches, and suggests "reconstructing an MR image by transforming the z-transformed MR data in remaining transverse dimension(s)." [See **Machida** page 3 paragraphs 0048, 0049; page 4 paragraph 0053 through page 7 paragraph 0114] The same reasons for rejection, that apply to **claims 1, 13** also apply to **claim 14**.

24. With respect to **Claim 15**, **Machida** teaches, and suggests "gridding the transformed MR data in dimension(s) perpendicular to the first direction to reconstruct an MR image. [See **Machida** page 3 paragraph 0048; page 6 paragraph 0090 through page 7 paragraph 0114] The same reasons for rejection, that apply to **claims 1, 13** also apply to **claim 15**.

25. With respect to **Claim 16**, **Machida** teaches, and suggests "An MRI apparatus to acquire multiple sets of MR data with a moving table and reconstruct MR images without slab-boundary

artifacts comprising: a magnetic resonance imaging (MRI) system having a plurality of gradient coils positioned about a bore of a magnet to impress a polarizing magnetic field, [See **Machida** Figure 1, page 2 paragraph 0036 through page 4 paragraph 0051] "and an RF transceiver system and an RF switch controlled by a pulse module to transmit RF signals to an RF coil assembly to acquire MR images" [See **Machida** Figure 1 page 2 paragraph 0036 through page 4 paragraph 0051] "a patient table movable fore and aft in the MRI system about the magnet bore" [See **Machida** Figure 1, page 3 paragraph 0041, Figure 1] "and a computer"[See **Machida** Figure 1 page 2 paragraph 0045 through page 4 paragraph 0056, host computer component 6] **Machida** teaches, and suggests that the computer is programmed to: "receive input defining a desired FOV larger than an optimal imaging volume of the MR[system; define a fixed slab with respect to the magnet to acquire MR data, acquire full MR data with frequency encoding in a direction of table motion, defined as z-direction, for a selected subset of the MR data acquired in at least one transverse dimension in the fixed slab; continuously move the patient table while maintaining position of the fixed slab; determine patient table position; and repeat the acquire and determine acts while the patient table is moving until an MR data set is acquired across the desired FOV to reconstruct an image of the FOV", [See **Machida** page 2 paragraph 0015 through page 7 paragraph 0114; Figures 1, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] Additionally each of these limitations were already addressed in the rejection of **claim 1**, therefore the same reasons for rejection, that apply to **claim 1,** also apply to **claim 16** and need not be reiterated.

26. With respect to **Claim 17**, **Machida** teaches, and suggests "the computer is further programmed to transmit magnetic gradient waveforms to encode a k-space trajectory that is

uniform in kz" [See **Machida** page 3 paragraph 0040 through page 6 paragraph 0088; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16,** also apply to **claim 17** and need not be reiterated.

27. With respect to **Claim 18**, which is the apparatus version of **claims 7, 13,** and **14** combined **Machida** teaches, and suggests that "the computer is further programmed to transform MR data with respect to z; align the z-transformed MR data to match anatomy across slab boundaries; and transform the z-transformed MR data with respect to at least one remaining dimension to reconstruct an MR image", for the same reasons provided in the rejections of **claims 7, 13,** and **14** of for rejection, that need not be reiterated therefore the same reasons for rejection, that apply to **claims 1, 7, 13, 14,** and **16,** also apply to **claim 18**.

28. With respect to **Claim 19**, this claim (i.e. "applying an RF pulse to excite a volume of interest; applying a k-space trajectory to encode the volume of interest, and filtering the acquired MR data to restrict the MR data to the defined fixed slab") is just an equivalent version of method **claim 5** in apparatus form, therefore the same reasons for rejection, that apply to **claims 1, 5,** and **16,** also apply to **claim 19** and need not be reiterated.

29. With respect to **Claim 20**, **Machida** teaches, shows and suggests "continuously moving the patient table to acquire the MR data set across the desired FOV." [See **Machida** abstract page 4 paragraph 0053 through page 5 paragraph 0066; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16,** also apply to **claim 20** and need not be reiterated.

30. With respect to **Claim 21**, **Machida** teaches, shows and suggests "acquiring all kz data for a selected subset of transverse k-space data, defining a set of magnetic field gradient waveforms to incrementally encode and acquire data in a given slab; and applying the set of magnetic field gradient waveforms in a cyclic order." [See **Machida** abstract page 2 paragraph 0039 through page 6 paragraph 0088; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16,** also apply to **claim 21** and need not be reiterated.

31. With respect to **Claim 22**, **Machida** teaches, shows and suggests "computer program to control a medical image scanner and create images across scanning boundaries without boundary artifacts"[See **Machida** abstract page 1 paragraph 0015 through page 7 paragraph 0114; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b], "the computer program having a set of instructions to control a computer to: select an FOV spanning an area greater than a predefined optimal imaging area of the medical image scanner;" [See **Machida** abstract page 1 paragraph 0015 through page 7 paragraph 0114; especially page 4 paragraph 0063 through page 5 paragraph 0066; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] "apply an RF pulse to excite a region in at least a first direction in the selected FOV" [See **Machida** abstract page 4 paragraph 0053 through page 6 paragraph 0088; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] "apply magnetic field gradients to encode the region in the first direction;" [See **Machida** abstract page 2 paragraph 0039 through page 6 paragraph 0088; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] "acquire k-space data in the first direction for a subset of at least one additional direction;" [See **Machida** abstract page 6 paragraph 0090 through page 7 paragraph 0114; Figures 5b, 6, 7a and

7b] "continuously reposition the predefined optimal imaging area with respect to an imaging object without interruption of motion;" [See **Machida** abstract page 6 paragraph 0090 through page 7 paragraph 0114; Figures 5b, 6, 7a and 7b] "track continuous movement of the predefined optimal imaging area with respect to an imaging object;" [See **Machida** abstract page 5 paragraph 0064 through page 6 paragraph 0066; Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] "and repeat the image data acquisition during continuous movement of the predefined optimal imaging area with respect to an imaging object until complete image data are acquired across the entire FOV to reconstruct an image of the FOV". [See **Machida** abstract page 2 paragraph 0015 through page 7 paragraph 0114; Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16,** also apply to **claim 22** and need not be reiterated.

32. With respect to **Claim 23**, **Machida** teaches, shows and suggests "the k-space data includes either one of 2D or 3D k-space data"[See **Machida** abstract page 3 paragraph 0048] "and having further instructions to acquire the k space data using frequency encoding in a direction of table movement". [See **Machida** abstract page 6 paragraph 0090 through page 7 paragraph 0114; Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16, 22** also apply to **claim 23** and need not be reiterated.

33. With respect to **Claim 24**, **Machida** teaches, shows and suggests "complete k-space data is acquired in z for a subset of at least one additional dimension." [See **Machida** page 6 paragraph 0090 through page 7 paragraph 0114; Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16, 22, 23** also apply to **claim 24** and need not be reiterated.

34. With respect to **Claim 25**, **Machida** teaches, shows and suggests "continuously moving a patient table for a number of acquisitions until a set of k space data are acquired for image reconstruction of a given slab." [See **Machida** abstract, page 1 paragraph 0015 through page 7 paragraph 0114; Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16, 22** also apply to **claim 25** and need not be reiterated.

35. With respect to **Claim 26**, **Machida** teaches, shows and suggests "Fourier transform MR data" [See **Machida** abstract, page 3 paragraph 0048] "in z;" [See **Machida** abstract, page 3 paragraph 0040] "sort and align the z-transformed MR data to match anatomic locations in z to fill a matrix." [See **Machida** page 4 paragraph 0053 through page 6 paragraph 0088; Figures 1, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16, 22** also apply to **claim 26** and need not be reiterated.

36. With respect to **Claim 27**, **Machida** teaches, shows and suggests "maintaining a position of a slab thickness fixed, relative to a magnet of the medical image scanner, during the imaging of the desired FOV and while repositioning the optimal imaging area" because this claim is just an equivalent version of method **claim 11** in apparatus form, therefore the same reasons for rejection, that apply to **claims 1, 11, 16, 22** also apply to **claim 27** and need not be reiterated.

37. With respect to **Claim 28**, **Machida** teaches, shows and suggests "the first direction is a z direction" [See page 3 paragraph 0040] "and the MR data acquired in the z-direction is represented in a number of retained pixels, and where MR data is acquired every sequence repetition and during table movement, and wherein the magnetic field gradients encode a trajectory that is uniform in kz". [See **Machida** page 2 paragraph 0039 through page 7 paragraph

0114; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16, 22** also apply to **claim 28** and need not be reiterated.

38. With respect to **Claim 29**, **Machida** teaches, shows and suggests " acquiring all kz data for a selected subset of transverse k-space; defining a set of magnetic field gradient waveforms to incrementally acquire data in each slab; and applying the set of magnetic field gradient waveforms over each slab."[See **Machida** page 2 paragraph 0039 through page 7 paragraph 0114; Figures 1, 2, 3, 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a and 7b] The same reasons for rejection, that apply to **claims 1, 16, 22** also apply to **claim 29** and need not be reiterated.

39. **Claims 1-4, 7, 8, 10-12,** and **22** are rejected under **35 U.S.C. 102(b)** as being anticipated by the **Dietrich et al.**, article "Extending the coverage of true volume scans by continuous movement of the subject" by Olaf Dietrich and Joseph V. Hajnal from The Robert Steiner Magnetic Resonance Unit, Hammersmith Hospital, Du Cane Road, London W120HS 1999.

40. With respect to **Claim 1**, the **Dietrich et al.**, article teaches and suggests "A method of imaging large volumes without resulting slab-boundary artifacts comprising: defining a desired FOV larger than an optimal imaging volume of an MR scanner;" [See **Dietrich et al.**, Discussion col. 2 where the teaching of scanning (i.e. MR scanning) over regions of space that are much longer than supported by limitations in magnet homogeneity, directly suggests that "the desired FOV is larger than an optimal imaging volume" (i.e. the area of magnetic homogeneity) "of an MR scanner;"] **Dietrich et al.**, teaches and suggests "selecting a slab thickness in a first direction" (i.e. 2-4cm) "that is smaller than the desired FOV" (i.e. 2-4cm is less than the desired FOV of 20cm) "and within the optimal imaging volume of the MR scanner;" (i.e. 2-4cm. Is less than the

optimal range of 5cm.), [See **Dietrich et al.**, col. 1- col. 2 under METHODS where the slab thickness along z is 2-4cm; with a desired field-of-view (FOV) of 20cm., with an optimal imaging range of 5cm.] **Dietrich et al.**, also teaches and suggests "continuously moving one of the optimal imaging volume and an imaging object in the first direction while repeatedly exciting and encoding spins with readout in the first direction to acquire data that is restricted to the selected slab thickness until at least one image of the FOV can be reconstructed." [See **Dietrich et al.**, col. 1- col. 2 under INTRODUCTION, CONCEPT, and METHODS.]

41. With respect to **Claim 2**, the **Dietrich et al.**, article teaches and suggests "the step of using another set of MR data to track motion of one of the optimal imaging volume and an imaging object." [See **Dietrich et al.**, col. 1 under CONCEPT, where repeating the phase encoding sequence without pausing after the full primary and secondary phase encoding is complete directly suggests that "another set of MR data is being used by **Dietrich et al.**, "to track motion of one of the optimal imaging volume and an imaging object."] The same reasons for rejection, that apply to **claim 1** also apply to **claim 2**.

42. With respect to **Claim 3**, the **Dietrich et al.**, article teaches and suggests "reconstructing the acquired data to form at least one of a 2D image and a 3D image". [See **Dietrich et al.**, Figure 1 a and b; col. 1- col. 2 under INTRODUCTION, CONCEPT, and METHODS which teach 3D reconstruction and show a two-dimensional reconstruction.] The same reasons for rejection, that apply to **claim 1** also apply to **claim 3**

43. With respect to **Claim 4,** the **Dietrich et al.**, article teaches and suggests "using a portion of the acquired MR data to track motion" (i.e. the shifts along the z-axis prior to a Fourier

Transform in both phase encoding directions) "of one of the optimal imaging volume and an imaging object." [See **Dietrich et al.**, col. 1 under CONCEPT, paragraph 1 sentences 5 and 6] The same reasons for rejection, that apply to **claim 1** also apply to **claim 4**.

44. With respect to **Claim 7,** the **Dietrich et al.**, article teaches and suggests "the first direction is defined as a z-direction. " [See **Dietrich et al.**, col. 1 under CONCEPT, paragraph 1 sentence 2] The same reasons for rejection, that apply to **claim 1** also apply to **claim 7**.

45. With respect to **Claim 8,** the **Dietrich et al.**, article teaches and suggests that "each MR data acquisition during continuous movement includes acquiring all k-space data in a direction of motion of a patient table for a selected subset" (i.e. a slab) "of transverse" (i.e. frequency or phase) "k-space data." [See **Dietrich et al.**, col. 1 under CONCEPT, paragraph 1 sentence 2]. The same reasons for rejection, that apply to **claim 1** also apply to **claim 8**.

46. With respect to **Claim 10,** the **Dietrich et al.**, article teaches and suggests "processing the set of MR data using a gridding reconstruction." [See **Dietrich et al.**, Figure 1 a and b; col. 1- col. 2 under INTRODUCTION, CONCEPT, and METHODS which teach 3D reconstruction and realignment of each line,. (i.e. the realignment for x, y, and / or z, directly suggests a grid type of reconstruction).] The same reasons for rejection, that apply to **claim 1** also apply to **claim 10**.

47. With respect to **Claim 11,** the **Dietrich et al.**, article teaches and suggests "the step of maintaining a position of slab thickness fixed relative to a magnet of the MR scanner during imaging of the desired FOV and the continuous moving of one of the optimal imaging volume and the imaging object" because **Dietrich et al.**, teaches that lines of full z encoded data are obtained with the position of the subject almost constant. [See **Dietrich et al.**, Figure 1 a and b; col. 1- col.

2 under INTRODUCTION, CONCEPT, and METHODS; especially CONCEPT col. 1 paragraph 1 sentence 4] The same reasons for rejection, that apply to **claim 1** also apply to **claim 11**.

48. With respect to **Claim 12,** the **Dietrich et al.**, article suggests "applying gradient waveforms on an axis parallel to the first direction while acquiring imaging data", because conventionally in MRI encoding is done by applying magnetic gradients, on a static main magnetic field, and in the **Dietrich et al.**, article the encodings (i.e. interpreted as gradient encodings by the examiner) occur with frequency encoding along X and primary phase encoding along Y augmented by secondary phase encoding in the slab (slice) (i.e. Z) direction. The examiner notes that because the subject is progressively (i.e. continuously) moved in the z-direction that the encoding in the slab slice direction, which occurs while imaging data is acquired, is also parallel to the "first direction" [See **Dietrich et al.**, Figure 1 a and b; col. 1- col. 2 under INTRODUCTION, CONCEPT, and METHODS; especially CONCEPT col. 1 paragraph 1 sentences 1 and 2] The same reasons for rejection, that apply to **claim 1** also apply to **claim 12**.

49. With respect to **Claim 22,** the **Dietrich et al.**, article suggests "A computer program (i.e. via a DEC alpha workstation) "to control a medical image scanner and create images across scanning boundaries without boundary artifacts, the computer program having a set of instructions to control a computer to:select an FOV spanning an area greater than a predefined optimal imaging area of the medical image scanner; [See **Dietrich et al.**, Discussion col. 2 sentence 1 where the teaching of scanning (i.e. MR scanning) over regions of space that are much longer than supported by limitations in magnet homogeneity, directly suggests that "the desired FOV is larger than an optimal imaging volume" (i.e. the area of magnetic homogeneity) "of an

MR scanner;"] **Dietrich et al.**, teaches and suggests "selecting a slab thickness in a first direction" (i.e. 2-4cm) "that is smaller than the desired FOV" (i.e. 2-4cm is less than the desired FOV of 20cm) "and within the optimal imaging volume of the MR scanner;" (i.e. 2-4cm. Is less than the optimal range of 5cm.), [See **Dietrich et al.**, col. 1- col. 2 under METHODS where the slab thickness along z is 2-4cm; with a desired field-of-view (FOV) of 20cm., with an optimal imaging range of 5cm.]

50. The **Dietrich et al.**, article also suggests applying "an RF pulse to excite a region in at least a first direction in the selected FOV" [See **Dietrich et al.**, col. 1- col. 2 under METHODS where the use of an RF spoiled gradient echo sequence directly suggests excitation by an RF pulse.] **Dietrich et al.**, teaches and suggests the steps of "applying magnetic field gradients to encode the region in the first direction;" [See **Dietrich et al.**, col. 1 CONCEPT paragraph 1] "acquiring k-space data in the first direction for a subset of at least one additional direction;" [See **Dietrich et al.**, col. 1& 2 CONCEPT paragraphs 1, 2] "continuously reposition the predefined optimal imaging area with respect to an imaging object without interruption of motion;" [See **Dietrich et al.**, col. 1& 2 INTRODUCTION sentence 5, CONCEPT paragraphs 1, 2; Figures 1a and 1b]

51. **Dietrich et al.**, also directly suggests the step of "tracking continuous movement of the predefined optimal imaging area with respect to an imaging object;" because **Dietrich et al.**, teaches and / or suggests that the amount of overlap is monitored and controlled so that the subject is moved half a slab width in each full encoding time to ensure equal treatment of all spatial points, which directly suggests that the continuous movement of the optimal image area

(i.e. the desired slab width, within the field of view) of the subject is tracked. [See **Dietrich et al.**, col. 1& 2 CONCEPT paragraphs 1, 2; the METHODS section and Figures 1a and 1b] **Dietrich et al.**, teaches and suggests "repeating the image data acquisition during continuous movement of the predefined optimal imaging area with respect to an imaging object until complete image data are acquired across the entire FOV to reconstruct an image of the FOV." [See **Dietrich et al.**, col. 1& 2 CONCEPT paragraphs 1, 2; the METHODS section and Figures 1a and 1b; INTRODUCTION sentence 5] The same reasons for rejection, that apply to **claim 1** also apply to **claim 22**.

52. **Claim 1** is rejected under **35 U.S.C. 102(b)** as being anticipated by **Yoshitome** Japanese Laid-open Patent Application (kokai) No. H6-311977 disclosed November 8th 1994. [The examiner is using the English version of this reference provided by applicant and submitted with applicant's Information Disclosure Statement].

53. With respect to **Claim 1, Yoshitome** teaches and suggests "A method of imaging large volumes" [See **Yoshitome** H6-311977 page 2 constitution paragraph; page 3 Industrial field of the invention paragraph] "without resulting slab-boundary artifacts" [See **Yoshitome** H6-311977 page 4 problem to be solved by the invention paragraph] "comprising: defining a desired FOV larger than an optimal imaging volume of an MR scanner;"[See **Yoshitome** H6-311977 page 5 Action paragraph 6 sentence 1].

54. **Yoshitome** teaches and suggests "selecting a slab thickness in a first direction that is smaller than the desired FOV and within the optimal imaging volume of the MR scanner;" [See **Yoshitome** H6-311977 page 5 Action paragraph 6 sentence 2], because the examiner considers

the term "subregion" in the context of the **Yoshitome** H6-311977 reference to constitute a "slab" with the "plurality of subregions" comprising applicant's "desired FOV that is larger than an optimal imaging volume of an MR scanner". Additionally, the examiner considers the phrase "the length in the direction of each subregion" to be equivalent to the "thickness" of each 'slab' or subregion. [See **Yoshitome** H6-311977 page 5 Action paragraph 6 sentence 2].

55. **Yoshitome** also teaches and suggests "continuously moving one of the optimal imaging volume and an imaging object in the first direction" [See **Yoshitome** H6-311977 pages 9-10 paragraph 24] "while repeatedly exciting and encoding spins with readout in the first direction" (i.e. the motion direction) "to acquire data that is restricted to the selected slab thickness" [See **Yoshitome** H6-311977 page 10 paragraph 27] "until at least one image of the FOV can be reconstructed. [See **Yoshitome** H6-311977 pages 9-12 paragraphs 23-37 Figure 8]

56. ***Claim Rejections - 35 USC § 103***

57. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

58. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

59. **Claims 13-14, 30** are rejected under **35 U.S.C. 103(a)** as being anticipated by the **Dietrich et al.**, article "Extending the coverage of true volume scans by continuous movement of the subject" from The Robert Steiner Magnetic resonance Unit, Hammersmith Hospital, Du Cane Road, London W12 0HS 1999. in view of **Machida** US Patent Application Publication US 2002/0115929 A1 published August 22nd 2002 which has an effective filing date available under **35 U.S.C. 102(e)** of September 21st 2001. The examiner notes that the instant application is a CIP of US patent application 09/681,420 filed march 30th 2001, however the CIP information of applicant's disclosure has a filing date of October 5th 2001, therefore the **Machida** reference is available as prior art against the CIP feature of "continuous motion" taught in applicant's claims.

60. With respect to **Claim 13,** the **Dietrich et al.**, article suggests "processing MR data to account for accrued phase resulting from table velocity; transforming MR data in a z-direction; correcting the MR data for spatial variations in the magnetic field in the direction of motion; and sorting, interpolating, and aligning the transformed MR data to match anatomic locations in the first direction." [See **Dietrich et al.**, Figure 1 a and b; col. 1- col. 2 under INTRODUCTION, CONCEPT, METHODS and Discussion;] the **Dietrich et al.**, article lacks directly teaching the step of "removing unnecessary data at the beginning and ending of each acquisition;" however **Machida** teaches this limitation [See **Machida** page 2 paragraph 0039 through page 6 paragraph 88; Figures 4a, 4b, 4c, 4d, 5a, 5b, 6, 7a, and 7b.] It would have been obvious to one of ordinary skill in the art, at the time that the invention was made that the **Machida** reference can be

combined with the teachings of **Dietrich et al.**, because both references teach an MRI method for scanning an area larger than the imaging volume of the magnet by moving the patient continuously through the MR device, and the **Machida** reference expands on the teachings of the **Dietrich et al.**, reference. The same reasons for rejection, that apply to **claim 1** also apply to **claim 13**.

61. With respect to **Claim 14,** the **Dietrich et al.**, article suggests "reconstructing an MR image by transforming the z-transformed MR data in remaining transverse dimension(s)." [See **Dietrich et al.**, col. 1& 2 CONCEPT paragraphs 1, 2; and Figures 1a and 1b] The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 13** also apply to **claim 14**.

62. With respect to **Claim 30,** the **Dietrich et al.**, article teaches and suggests "selecting a larger slab thickness than that used for imaging, repetitiously acquiring MR data for the larger slab thickness in a direction of table movement; determining a set of overlapping MR data; and estimating at least one of table velocity and table position from the set of overlapping MR data." [See **Dietrich et al.**, Figure 1 a and b; col. 1- col. 2 under INTRODUCTION, CONCEPT, METHODS and Discussion] The same reasons for rejection, obviousness, and motivation to combine that apply to **claims 1, 22** also apply to **claim 30**.

63. The **prior art made of record** and not relied upon is considered pertinent to applicant's disclosure.

A) **Wang** US patent 5,928,148 issued July 27th 1999.

B) **Yoshitome** Japanese Laid-open Patent Application (kokai) No. H6-304153 disclosed November 1st 1994.

Conclusion

64. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tiffany Fetzner whose telephone number is (703) 305-0430. The examiner can normally be reached on Monday-Thursday from 7:00am to 4:30pm., and on alternate Friday's from 7:00am to 3:30pm.

65. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Lefkowitz, can be reached on (703) 305-4816. The fax phone number for the organization where this application or proceeding is assigned is (703)305-3432 .

66. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 305-0956.

Tiffany A. Fetzner

TAF

February 10, 2003

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